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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

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U.S. Training and
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Technical Report
S-157 R

Development of USTES

APTITUDE TEST
BATTERY FOR

PACKAGING-MACHINE MECHANIC

(drug. prep. & rel. prod.)
920.280

U.S DEPARTMENT OF LABOR
Manpower Administration

TM 001 589

Technical Report on Development of USTES Aptitude Test Battery

For . . . . . .

Packaging-Machine Mechanic (drug. prep. & rel. prod.) 920.280

S-157R

(Developed in Cooperation with the Missouri and New Jersey State Employment Services)

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
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U. S. Department of Labor
Manpower Administration

June 1970

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

Development of USTES Aptitude Test Battery

For

Packaging-Machine Mechanic (drug. prep. & rel. prod.) 920.280-014

S-157R

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Packaging-Machine Mechanic (drug prep. & rel. prod.) 920.280-014. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
S - Spatial Aptitude	70
K - Motor Coordination	80
F - Finger Dexterity	90
M - Manual Dexterity	100

Research Summary

Sample:

103 workers employed as Package-Machine Mechanics. This study was conducted prior to the requirement of providing minority group information. Therefore, minority group status is unknown.

Criterion:

Supervisory ratings.

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the bais of a job analysis and statistical analyses of aptitude mean scores, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .56 ($P/2 < .0005$)

Effectiveness of Norms:

Only 67% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 90% would have been good workers. Thirty-three percent of the nontest-

selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 10% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	67%	90%
Poor Workers	33%	10%

SAMPLE DESCRIPTION

Size:

N = 103

Occupational Status:

Employed Workers.

Work Setting:

Workers were employed by the Rexall Drug Company, St. Louis, Missouri, and by the following companies in New Jersey:

Ivers-Lee Incorporated, Newark
Hoffman-LaRoche, Nutley
Merck and Company, Rahway and Linden
White Laboratories, Kenilworth
Ciba Pharmaceuticals, Summit
Mennen Company, Morristown
Bristol-Meyers, Hillside
Private Brands, Clifton
Warner-Chilcott-Warner-Lambert, Morris Plains
Sandoz Pharmaceuticals, East Hanover

Employer Selection Requirements:

Education: None required.

Previous Experience: None required.

Tests: None used by most firms. Three firms used two mechnical aptitude tests.

Other: Personal interview.

Principal Activities:

The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience:

All workers in the final sample had at least one year job experience. Three workers reported less than one year experience but they had been employed in other establishments as Packaging-Machine Mechanic for at least one year.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience

	Mean	SD	Range	r
Age (years)	37.0	9.8	20-61	-.251*
Education (years)	10.4	1.8	7-16	.152
Experience (months)	69.7	52.4	4-243	-.053

*Significant at the .05 level.

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002A, were administered during 1957 and October, 1958.

CRITERION

The criterion for each sample consisted of supervisory ratings made on a descriptive rating scale covering nine different aspects of job performance. The ratings for each of the items were made on a five-point scale.

Since the individuals in each sample performed similar job duties and were sufficiently similar in respect to age and education, the samples were combined into a total sample on the basis of both statistical and qualitative considerations.

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 33% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers".

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Tables 3, 4 and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performance)

Aptitudes	Rationale
G - General Learning Ability	Required in all phases of setting-up the packaging machinery, in analyzing and diagnosing defective operations, and in determining remedial measures required.
N - Numerical Aptitude	Required in making accurate computations and in integrating the instrument readings.
S - Spatial Aptitude	Required in reading and interpreting blueprints, in all phases of setting-up the packaging machinery, in analyzing and diagnosing defective operations, and in determing remedial measures required.
P - Form Perception	Required in distinguishing between differences in shapes, widths and lengths of objects.
K - Motor Coordination	Required in making rapid and accurate movements with fingers when repairing, setting up, and adjusting machines.
F - Finger Dexterity	Required in positioning, adjusting, and fingering small parts, screws, bolts, and other accessories.
M - Manual Dexterity	Required in handling gears, shafts, cams, and hand tools.

TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 103

	Mean	SD	Range	r
G - General Learning Ability	95.9	15.7	47-132	.340**
V - Verbal Aptitude	94.4	13.7	61-125	.240*
N - Numerical Aptitude	91.7	16.8	32-124	.347**
S - Spatial Aptitude	99.4	19.2	51-140	.330**
P - Form Perception	92.5	18.0	16-129	.415**
Q - Clerical Perception	95.6	13.7	48-120	.278**
K - Motor Coordination	99.4	17.0	43-146	.390**
F - Finger Dexterity	100.0	19.7	54-145	.435**
M - Manual Dexterity	111.7	20.0	62-155	.490**

*Significant at the .05 level.
**Significant at the .01 level.

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X		X	X	X		X	X	X
Irrelevant									
Relatively High Mean				X			X	X	X
Relatively Low Standard Dev.		X				X			
Significant Correlation with Criterion	X	X	X	X	X	X	X	X	X
Aptitudes to be Considered for Trial Norms	G	V	N	S	P	Q	K	F	M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of aptitudes G, V, N, S, P, Q, K, F, and M at trial cutting scores were able to differentiate between the 67% of the sample considered to be good workers and the 33% of the sample considered to be poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample; for two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of S-70, K-80, F-90, and M-100 provided optimum differentiation for the occupation of Packaging-Machine Mechanic (drug. prep. & rel. prod.) 920.280-014. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .56 (statistically significant at the .0005 level).

TABLE 6

Concurrent Validity of Test Norms
S-70, K-80, F-90, and M-100

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	15	54	69
Poor Workers	28	6	34
Total	43	60	103

Phi Coefficient = .56 Chi Square (X^2_y) = 32.0

Significance Level = $P/2 < .0005$

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-47 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A Phi Coefficient of .42 is obtained with the OAP-47 norms of S-80, F-80 and M-85.

SP-21

A-P-P-E-N-D-I-X

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

Score____

RATING SCALE FOR _____
D. O. T. Title and Code

Directions: Please read Form SP-20, "Suggestions to Raters", and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

Name of Worker (print) _____
(Last) (First)

Sex: Male_____ Female_____

Company Job Title: _____

How often do you see this worker in a work situation?

☐ See him at work all the time.

☐ See him at work several times a day.

☐ See him at work several times a week.

☐ Seldom see him in work situation.

How long have you worked with him?

☐ Under one month.

☐ One to two months.

☐ Three to five months.

☐ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.

☐ 2. Capable of low work output. Can perform at a slow pace.

☐ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.

☐ 4. Capable of high work output. Can perform at a fast pace.

☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

☐ 1. Performance is inferior and almost never meets minimum quality standards.

☐ 2. The grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.

☐ 3. Performance is acceptable but usually not superior in quality.

☐ 4. Performance is usually superior in quality.

☐ 5. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

☐ 1. Makes very many mistakes. Work needs constant checking.

☐ 2. Makes frequent mistakes. Work needs more checking than is desirable.

☐ 3. Makes mistakes occasionally. Work needs only normal checking.

☐ 4. Makes few mistakes. Work seldom needs checking.

☐ 5. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.

☐ 2. Has little knowledge. Knows enough to "get by."

☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.

☐ 4. Has broad knowledge. Knows enough to do good work.

☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

☐ 1. Has great difficulty doing his job. Not at all suited to this kind of work.

☐ 2. Usually has some difficulty doing his job. Not too well suited to this kind of work.

☐ 3. Does his job without too much difficulty. Fairly well suited to this kind of work.

☐ 4. Usually does his job without difficulty. Well suited to this kind of work.

☐ 5. Does his job with great ease. Exceptionally well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

☐ 1. Cannot perform different operations adequately.

☐ 2. Can perform a limited number of different operations efficiently.

☐ 3. Can perform several different operations with reasonable efficiency.

☐ 4. Can perform many different operations efficiently.

☐ 5. Can perform an unusually large variety of different operations efficiently.

G. How resourceful is he when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 1. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. How many practical suggestions does he make for doing things in better ways? (Worker's ability to improve work methods.)

☐ 1. Sticks strictly with the routine. Contributes nothing in the way of practical suggestions.

☐ 2. Slow to see new ways to improve methods. Contributes few practical suggestions.

☐ 3. Neither quick nor slow to see new ways to improve methods. Contributes some practical suggestions.

☐ 4. Quick to see new ways to improve methods. Contributes more than his share of practical suggestions.

☐ 5. Extremely alert to see new ways to improve methods. Contributes an unusually large number of practical suggestions.

I. Considering all the factors already rated, and <u>only</u> these factors, how acceptable is his work? (Worker's "all-around" ability to do his job.)

☐ 1. Would be better off without him. Performance usually not acceptable.

☐ 2. Of limited value to the organization. Performance somewhat inferior.

☐ 3. A fairly proficient worker. Performance generally acceptable.

☐ 4. A valuable worker. Performance usually superior.

☐ 5. An unusually competent worker. Performance almost always top notch.

FACT SHEET

Job Title: Packaging-Machine Mechanic (drug. prep. & rel. prod.), 920.280-014

Job Summary: Sets up, adjusts, and maintains one or several packaging lines consisting of various types of machines such as, filling, cotton inserting, capping, labeling, ampule printing, cartoning, and casing machines, used to package pharmaceutical products in liquid, cream, granular, tablet, capsule, and ampule form. Uses mechanic's hand tools, such as screwdriver, pliers, socket wrenches, hammer, and mallet.

Work Performed: Sets up one or more lines of packaging machines: Receives oral and written instructions from supervisor, studies simple blueprints, adapts machines to perform functions called for in instructions by changing dies, altering lengths of belts, changing shape, slope, or angle of metal guides through which the bottles, cans, boxes, or tubes pass in order to undergo such processes as filling, capping, labeling, packaging, and cotton inserting.

Adjusts several machines which perform different functions so that they will operate in unison: Correlates speeds of machines in the line by observing time, adjusting set screws, reading and interpreting gages, changing positions of levers and wheels, and integrating a number of instrument readings so that each machine processes the same number of units per minute. Checks weights of products by matching container and contents against standard container and contents. Continues making adjustments until sample product closely conforms with standard product.

Repairs machines: Determines visually, audibly, by touch and by smell if machine is correctly functioning. Diagnoses the cause or causes of faulty operation and makes necessary adjustments usually by turning set screws; or, if necessary, dismantles machine using mechanic tools such as pliers, screwdrivers, wrenches, and hammer, and replaces or repairs broken parts.

Effectiveness of Norms: Only 67% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-157-R norms, 90% would have been good workers. 33% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-157-R norms, only 10% would have been poor workers.

Applicability of S-157-R Norms: The aptitude test battery is applicable to jobs which include a majority of duties described above.

GPO 898-738